Records of the eels *Kaupichthys atronasus* (Chlopsidae), *Phyllophichthus xenodontus* (Ophichthidae), and *Gorgasia preclara* (Congridae) from the Red Sea

by

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Abstract. – *Kaupichthys atronasus* Schultz, 1953 is recorded from two specimens from Egypt and Saudi Arabia. *Phyllophichthus xenodontus* Gosline, 1951 is recorded from two specimens collected from Egypt. Geographic variation in this species is discussed. *Gorgasia preclara* Böhlke & Randall, 1981 is recorded from a photograph taken of a live individual at Dahab, Egypt.

Résumé. – Signalement des anguilles *Kaupichthys atronasus* (Chlopsidae), *Phyllophichthus xenodontus* (Ophichthidae), et *Gorgasia preclara* (Congridae) dans la mer Rouge.

Kaupichthys atronasus Schultz, 1953 est signalée par deux spécimens d'Égypte et d'Arabie Saoudite. *Phyllophichthus xenodontus* Gosline, 1951 est signalée par deux spécimens collectés en Égypte. La variation géographique de cette espèce est discutée. *Gorgasia preclara* Böhlke & Randall, 1981 est enregistrée à partir d'une photographie prise d'un individu vivant à Dahab, Égypte.

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The chlopsid eel *Kaupichthys atronasus* Schultz, 1953 and the ophichthid *Phyllophichthus xenodontus* Gosline, 1951 have recently been reported from the Red Sea, the former by Allen and Erdmann (2012: 73), the latter by Golani and Bogorodsky (2010: 12). Both these records were based on museum catalogue records, but no further information was given. In this paper, we confirm and document the presence of these two species in the Red Sea. In addition, we report the first occurrence of the garden eel *Gorgasia preclara* Böhlke & Randall, 1981 (Congridae) from the Red Sea, based on a photograph taken at Dahab, Egypt.

MATERIALS AND METHODS

Specimens are deposited at the Smithsonian Institution, Washington DC, USA (USNM, 12 spms) and the Senckenberg Museum, Frankfurt, Germany (SMF, 1 spm). Counts of vertebrae were made on digital radiographs. Measurements were made by caliper and taken to the nearest 0.1 mm. All counts and measurements followed Böhlke (1989). Eschmeyer's (2013) online catalog was consulted for bibliographic information. Abbreviations are as follows: IO, infraorbital; LL, lateral line; PA, preanal; PD, predorsal; POM, preoperculo-mandibular; SO, supraorbital; ST, supratemporal; TL, total length.

Kaupichthys atronasus Schultz, 1953
(Fig. 1)

Kaupichthys atronasus Schultz, 1953: 65, fig. 14 (Marshall Is.); holotype USNM 141260. Böhlke and Smith, 1968: 27 (Solomon Is. and New Britain, additional meristic data given). Asano, 1984: 22 (Japan). Paxton *et al*., 1989: 137 (Australia). Winterbottom *et al*., 1989: 6 (Chagos Archipelago, Indian Ocean). Myers, 1999: 41-42 (throughout Micronesia). Tighe, 2000 (South China Sea). Allen and Adrim, 2003: 22 (Indonesia). Allen *et al*., 2007 (Christmas Island, Indian Ocean). Fricke *et al*., 2011: 349 (New Caledonia). Allen and Erdmann, 2012: 73 (Red Sea, etc.).

Material

USNM 313654 (1 specimen, 128 mm TL), Egypt, NW coast Gulf of Aqaba, 0-18 m, 16 Jul. 1969, Springer *et al*. coll.; SMF 34947 (1 spm, 76 mm TL), 20°15.211'N, 39°59.380'E, Saudi Arabia, Al-Lith, 10 m, 08 Mar. 2012, Bogorodsky and Alpermann coll.

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Description (based on two Red Sea specimens)

In % TL: preanal 33, predorsal 14-15, head 13-14, depth at anus ca 3. In % head length: snout 17-20, eye 7-10, interorbital 17-19, snout-rictus 30-31, pectoral fin 20. Pores: LL 1, POM 6, IO 4, SO 3, ST 0. Pectoral-fin rays 10. Vertebrae: PD 10, PA 32, Total 112 (2 specimens).

Body moderate in length, anus near first third of TL. Dorsal and anal fins confluent with caudal fin, dorsal fin begins approximately above gill opening, anal fin begins immediately behind anus; pectoral fins present. Eyes well-developed. Rictus slightly behind posterior margin of eye. Anterior nostril tubular, near tip of snout, directed anterolaterally; posterior nostril on edge of upper lip, near anterior margin of eye. Lateral line reduced, only a single pore in branchial region anterior to gill opening. Teeth small and conical; intermaxillary teeth in a short patch at anterior end of roof of mouth; maxillary and dentary teeth in narrow rows; vomerine teeth in two long series on each side, widely diverged, each closer to maxillary series than to its counterpart on other side.

Three supraorbital pores: one at tip of snout just above lip (the ethmoidal pore, by convention treated as part of the supraorbital series), one at tip of snout just above previous one, and one on top of snout medial to anterior nostril. Four infraorbital pores along upper lip: one just behind anterior nostril, one between anterior and posterior nostrils, one below anterior margin of eye, one below posterior margin of eye; no pores in ascending branch of canal behind eye. Six pores in mandibular section of preoperculo-mandibular canal, all anterior to rictus; no pores in preopercular section. No pores in supratemporal canal.

Colouration (based on photograph of fresh specimen)

Semitranslucent with small irregular brown blotches on body and head; a large diffuse dark brown blotch behind eye, and dark brown vertical streak before eye; anterior nostril and area immediately around base of nostril black, nostril tips white; red gills visible through skin; fins uniform pale grey. Colour of preserved specimens similar, with some variation in intensity of brown blotches.

Distribution and habitat

Central Pacific and Indian Ocean, from the Marshall Islands to the Red Sea; in the Pacific from Japan in the north to Australia in the south; in the Indian Ocean reported from Chagos Archipelago and Christmas Island only (Winterbottom *et al*., 1989; Allen *et al*., 2007). Found in shallow water around coral reefs; most specimens collected with ichthyocide. Specimen from Al Lith, Saudi Arabia, was collected from a crevice, deep inside the fringing reef at a depth of 10 m.

Remarks

The species of the genus *Kaupichthys* occur in all oceans.

Figure 1. - *Kaupichthys atronasus*, SMF 34947 (76 mm TL). Photo S. Tränkner. Scale bar = 10 mm.

Figure 2. - *Phyllophichthus xenodontus*, USNM 314692 (193 mm TL). Photo S. Raredon. Scale bar = 10 mm.

Three species are known from the Indian Ocean: *K. atronasus*, *K. brachychirus* and *K. diodontus*, all described by Schultz, 1953. The latter two are easily distinguished by their plain brown colour; *K. brachychirus* is characterised by very short pectoral fins. Randall *et al*. (1997) reproduced a photo of a fresh specimen of *K. atronasus* and described the tip of the snout as black. We examined 28 lots of *Kaupichthys atronasus* from all over the Indo-Pacific, and all have the same colour pattern as the Red Sea specimens: snout

colour like the head, with a black blotch around the base of anterior nostrils only. In none was the tip of the snout black. As mentioned above, there is some variation in the intensity of the brown blotches, and we suspect that Randall *et al*. (1997) may simply have had a specimen with unusually dark blotches and interpreted this as black. There is very little geographic variation in *Kaupichthys atronasus* over its range. The holotype from the Marshall Islands has 114 vertebrae, and the two specimens from the Red Sea both have 112. Chlopsid eels tend to be remarkably uniform in their main characters, showing little variation in colour, pores and vertebral number, and proportions within species. It is possible that genetic data would show more heterogeneity, but such data are not yet available for this species.

Phyllophichthus xenodontus Gosline, 1951
(Figs 2, 3; Tab. I)

Phyllophichthus xenodontus Gosline, 1951: 316, fig. 17a, b (Hawaiian Is.); holotype USNM 162709 (formerly Univ. of Hawaii 318). McCosker, 1979: 64 (Hawaiian Is.). McCosker and Castle, 1986: 185 (South Africa). Allen and Swainston, 1988: 34 (Australia). Myers, 1999: 57 (Micronesia). Randall and Earle, 2000: 8 (Marquesas Is.). Allen and Adrim, 2003: 24 (Indonesia). Heemstra *et al*., 2004: 3316 (Rodrigues, Mascarene Is.). Randall, 2007: 69 (Hawaiian Is.). Ho *et al*., 2010: 30 (Taiwan). Golani and Bogorodsky, 2010: 12 (Red Sea).

Phyllophichthus macrurus McKay, 1970: 4 (Western Australia); holotype: WAM P.4015-001.

Material

Red Sea: USNM 314692 (2 spms, 167-193 mm TL), Egypt, Gulf of Aqaba, Bay at El Himeira, 9-12 m, 8 Sep. 1969, Springer *et al*. coll. **Seychelles**: USNM 314690 (1 spm, 206 mm TL), Seychelles, Aldabra Atoll, West I., flat in front of beach facing Settlement Camp, 0-0.8 m, 14 Aug. 1967, Fehlman coll.; USNM 314691 (1 spm, 247 mm TL), same locality, 20 Aug. 1967, Fehlman coll. **Taiwan**: USNM 314694 (1 spm, 390 mm TL), southern Taiwan, Pingtung County, Cut between large outstanding rock and Ch'uan-fan-shih, 0-6 m, 23 Apr. 1968, Springer *et al*. coll. **Solomon Islands**: USNM 383451 (1 spm, 202 mm TL), Solomon Islands, Santa Cruz Islands, Duff Islands, Lakao at northwest end at Temomoa Point in a small cove in surge channels in big boulders, 0-10 m, 24 Sep. 1998, Williams *et al*. coll. **Vanuatu**: USNM 350167 (2 spm, 354-284 mm TL), Vanuatu, Erromango, Dillon's Bay, tide pool on SW side of bay along Williams Point, 0-1 m, 25 May 1996, Williams *et al*. coll.; USNM 363457 (1 spm, 313 mm TL), Vanuatu, Banks Islands, Mota Lava, Milli Bay, rubble and sand area at base of a reef slope, 23-29 m, 19 May 1997, Williams *et al*. coll.

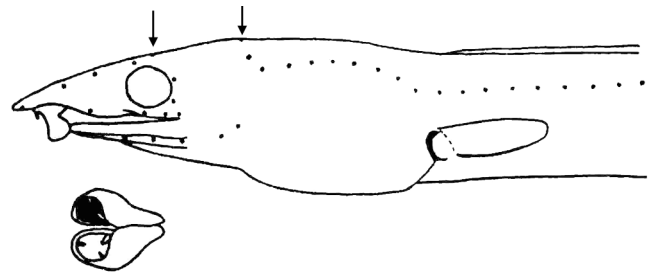

Figure 3. - *Phyllophichthus xenodontus*, head showing pores and nostrils. Modified from Gosline (1951: fig. 17a). Arrows indicate median pores.

Marquesas Islands: USNM 408708 (1 spm, 321 mm TL), Marquesas, Motu One, west side, 7-9 m, 1 Nov. 2011, Williams *et al*. coll. **Hawaii**: USNM 162709 (holotype, 239 mm TL), Oahu, Hauula Park, 28 Jun. 1949, Gosline *et al*. coll.

Description

In % TL: preanal 44.3-51.0, predorsal 8.4-10.7, head 7.9-10.0, depth at anus 1.7-2.4. In % head length: snout 23.8-27.2, eye 8.2-11.9, interorbital 8.6-11.0, snout-rictus 34.1-39.4, snout-lower jaw 9.3-12.1, gill opening 6.1-9.9, interbranchial 12.1-15.7, pectoral fin 13.8-27.2. Pores: LL 75-ca 83, POM 6, IO 6, SO 4 + 1, ST 3. Vertebrae: PD 9-11, PA 69-83, Total 156-180.

(From Gosline 1951, with some added data). Head and body subcylindrical, becoming compressed toward tip of tail; anus near midlength. Dorsal and anal fins low, discontinuous, caudal fin absent, tip of tail pointed and hardened. Dorsal fin on both Red Sea specimens begins over approximately posterior third of appressed pectoral fin; anal fin begins shortly behind the anus; pectoral fins well-developed. Gill opening round, slightly below mid-side of body, opening onto lower part of pectoral-fin base. Eyes well developed. Snout long and tapering, overhanging tip of lower jaw, somewhat depressed at tip, lower surface flattened, with a median groove extending nearly to tip. Anterior nostril large and conspicuous, on ventral side of snout opposite tip of lower jaw, directed ventrally; three prominent papillae on anterior, right and left sides, and a prominent leaf-like flap on posterior border, those of the two sides touching each other. Posterior nostril opening into mouth under a broad, infolded flap which is delimited on outside of upper lip as a groove below anterior border of eye.

Teeth conical; intermaxillary teeth well developed, arranged as five pairs in parallel longitudinal rows; about four weak teeth in inner edge of maxilla before posterior nostril, four or more even weaker embedded teeth behind; lower jaw with a row of some 18 strong laterally directed teeth on each side, these rows not continued forward around toothless symphysis; vomerine teeth absent.

Table I. - Vertebrae in *Phyllophichthus xenodontus* (range of counts for Hawaii from McCosker, 1979). H = holotype.

Total	156	157	--	164	165	166	167	168	169	170	171	172	173	174	175	…	180
Red Sea	2		--													…	
Aldabra			--	1				1								…	
Taiwan			--				1									…	
Solomon Is.			--					1								…	
Vanuatu			--							3						…	
Marquesas			--													…	1
Hawaii			--					←	–	–	–	–	H	–	–	→	…	
Preanal	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83		
Red Sea	1		1														
Aldabra						1			1								
Taiwan								1									
Solomon Is.								1									
Vanuatu						1		1			1						
Marquesas															1		
Hawaii													H				

Preoperculo-mandibular canal with six pores: first on underside of lower jaw, slightly before tip and just before anterior end of longitudinal dermal groove; second below anterior margin of eye; third below mideye; fourth slightly behind posterior margin of eye and directly below posterior-most infraorbital pore; fifth in preopercular canal behind rictus; sixth above and behind, and close to, the fifth pore. Six infraorbital pores: first on edge of upper lip, about midway between anterior nostril and eye; second below mideye; third below posterior margin of eye; fourth slightly before rictus; fifth above and somewhat anterior to the fourth, behind eye and slightly below mideye level; sixth behind eye and slightly above mideye. Four paired supraorbital pores: first small, on underside of snout near tip; second on top of snout above posterior base of anterior nostril; third on top of snout about midway between anterior nostril and eye; fourth on top of head slightly before mideye; a fifth unpaired median pore in the commissure connecting right and left sides, near mideye level. Three supratemporal pores, a median pore and one on each side.

The colour of the two Red Sea specimens in preservative is a nearly uniform light brown in general appearance. The dorsal surface of the head and trunk is covered with small, closely spaced, light brown spots; on the tail, the speckled pattern descends to cover nearly the entire body. The fins are colourless.

Distribution and habitat

From Hawaii and French Polynesia in the east, westward to Japan and Australia in the Pacific, and through the Indian Ocean to the east coast of Africa and the Red Sea. Found in relatively shallow water, most specimens collected with ichthyocide.

Remarks

Significant variation occurs over the range of this species, most noticeably in the number of vertebrae (Tab. I). The two specimens from the Red Sea have fewer total (156) and preanal vertebrae (69-71) than those from elsewhere (164-180 and 74-83 respectively); there is also a slight difference in predorsal vertebrae (11 vs 9-10). At the other end of its range, the specimen from the Marquesas has more total vertebrae (180) than any of the others, and it also has significantly more preanal vertebrae (83). The specimens from the Seychelles seem to have slightly fewer vertebrae (164-168) than those from the western Pacific (167-170). Specimens from Hawaii have 168-175 total vertebrae (McCosker, 1979) a number similar to the western Pacific specimens, but the preanal count of 81 in the holotype is much higher and in fact is closer to the Marquesas specimen. There are also a few slight differences in proportions. For example, the Red Sea specimens have a slightly shorter preanal length (44.3-47.7%TL vs 48.1-51.0) than the others. The pectoral fin is shorter in the Red Sea specimens (13.8-17.8% head) than the others (18.9-27.2%). However, the Hawaiian holotype is an outlier here, with length of 27.2% head; the next highest value is 24.4% head in the specimen from Taiwan. It appears, then, that this species consists of several populations that vary to differing degrees in different characters. Our sample size is too small to assess the range of variation within each population, and there is no way to determine the geographic boundaries between populations. For this reason, we refrain from applying names to any of them at this time. The nature and extent of geographic variation has not been determined for the great majority of Indo-Pacific eel species. Much work remains to be done.

***Gorgasia preclara* Böhlke & Randall, 1981**
(Fig. 4)

Gorgasia preclara Böhlke & Randall, 1981: 44, figs 2, 27, 29 (Maldives and Philippines); holotype BPBM 21012. Okubo *et al*., 1984 (Ryukyu Is.). Myers and Donaldson, 1996: 212 (Guam). Randall *et al*., 1997: 494 (Indonesia and Coral Sea). Myers, 1999: 58 (Palau). Castle and Randall, 1999: 45 (New Guinea). Allen and Erdmann, 2012: 115 (Indonesia).

Material

None

Description

A garden eel of the genus *Gorgasia* (flanges on upper lip not continuous around tip of snout) characterized by a distinctive and conspicuous colour pattern of pale bars on a brown background and a relatively low vertebral count (144-152).

Distribution and habitat

Recorded from the Ryukyu Islands to the Coral Sea in the western Pacific, through the Philippines and Indonesia to the Maldive Islands and the Red Sea. Occurs on sand and rubble bottoms, generally in depths of less than 50 m. Garden eels live in burrows, with the posterior part of the body inserted in the substrate and the anterior part extended into the water column, where they feed on small organisms that drift by. When threatened, they retreat into their burrows.

Remarks

We record this species on the basis of a photograph (Fig. 4) taken in Mashraba Bay, at Dahab, Egypt, on the east coast of the Sinai Peninsula. Later, in November of 2012, the eel was observed by the second author on a steep slope with patch of coarse sand at a depth of 14 m; an attempt at collection was unsuccessful. The distinctive colour pattern of white bars on a brown background is unmistakable; all of the other species of *Gorgasia* have a mottled colour pattern with at most some small pale spots. Only the anterior part of the body shows in our photograph; characteristically for garden eels, the posterior part is buried in the substrate. The pale bars are shorter than those of the holotype, in which they circle the body anteriorly. However, a specimen from the Maldives (Castle and Randall, 1999: pl. 3G) has smaller, spot-like bars resembling those in our photograph. As pointed out by Castle and Randall (1999: 45), D'Ancona (1928: 47, pl. 3, figs. 6-8b) described a leptocephalus larva of *Gorgasia* from the Red Sea under the name *Leptocephalus cotroneii*, with 147-149 myomeres. This is within the range of *G. preclara* and could well represent the larva of that species. D'Ancona's name predates Böhlke and Randall's and would take precedence. Without a specimen in hand to confirm the characters, however, especially the number of vertebrae, we cannot verify the identification. For that reason we refrain from applying the larval name to this species.

Figure 4. - *Gorgasia preclara*, Mashraba Bay, Dahab, Egypt. Photo C. von March.

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